IoT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

NALAIYATHIRAN PROJECT BASED LEARNING

On

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTERPRENEURSHIP

A PROJECT REPORT

Submitted by

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BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AENGINEERING

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NOVEMBER 2022
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NOVEMBER 2022
BONAFIDE CERTIFICATE

Certified that this project report titled "**IoT BASED SMART CROP**

PROTECTION SYSTEM FOR AGRICULTURE by NALAIYA THIRAN PROJECT BASED LEARNING Program*"*, is the bonafide work of **K.ARCHANA (42019104001),A.JOSEPHINE MARRY (420119104015) ,M.PRIYADHARSHINI (420119104020) ,G.TAMIZHSELVI (420119104043)** who carried out the work under faculty mentor and industry mentor supervision, for the partial fulfillment of the requirements for the award of the degree of **BACHELOR OF ENGINEERING IN COMPUTER SCIENCE ENGINEERING.**

Certified further that to the best of my knowledge and belief, the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or an award was conferred on an earlier occasion.

DECLARATION

I, hereby declare that the Project work entitled "**IoT Based Smart Crop Protection for Agriculture System by NALAIYATHIRAN PROJECT BASED LEARNING program***"* submitted to the IBM November 2022 in partial fulfillment for the award of the degree of **BACHELOR OF ENGINEERING IN COMPUTER SCIENCE ENGINEERING,** is the report of the original project work done by us under the guidance of Dr.M.Shanthi (Faculty Mentor), Assistant Professor, Department Electronics and Communication Engineering, University College of Engineering, Ramanathapuram.

NAME

K.ARCHANA

(Team Leader)

I certify that the declaration made by the above candidate is true.

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FACULTY MENTOR,
Assistant Professor
Computer science engineering
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Kallakurichi 606202

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ABSTRACT

The system will provide a complete technical solution to the destruction of crops by animals using internet of things to prevent crops from animals. Agriculture is the backbone of the economy but because of animal attacks, climate changes in agricultural lands there will be huge loss of crops. The feature of this paper includes the development of the system that can monitor Temperature, Humidity, Soil moisture and even the movement of animals which may destroy the crops in agricultural fields. The IoT based smart farming system being proposed via this report is integrated with Microcontroller mixed with different sensors and a WiFi module producing live data feed that can be obtained online. The moisture contents in the soil sensed by using the moisture sensor and it will identify the amount of water supplied required to the crop and sends data to ARM cortex and enables sensor to supply water which automatically turn on the water source and turn off it when need is satisfied. PIR sensor used to detect whether a human has moved in or out of the sensors range. After processing the available information, if the human is not found the system raised the buzzer sound, to alert people about intrusion.

The system to monitor agricultural land is developed by using WSN. IoT monitored data is sent to cloud so that farmers can get the data easily. IoT enabled agriculture system is greatly beneficial to the farmers as it reduces the man power and harmful chemical for increasing the amount of the

crops. Using IoT technology it helps the farmers to control their fields anywhere is simple and now it is cost effective .If any problem arises, the announcement sends to mobile of farmers. The farmers can rectify the problem by through mobile. IoT based smart farming is used to monitor the field in proper time by any time and being anywhere.

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1. INTRODUCTION

1.1Project Overview

IoT (Internet of Things) tendencies are often utilized in smart farming to boost the standard of agriculture. The moderate smart agriculture systems are utilized to afford the solution for moisture related issues like weather conditions such as temperature, humidity and moisture.

This system used to track and identify animals visually. The motion sensor will activate a buzzer or alarm if any unwanted motion is detected so that we can protect crop from animals.

1.2 Purpose

The main aim of our project is to protect crop from damage caused by animal. This leads to huge loss for farmers. It is not possible for farmers

to barricade entire fields on 24 hours. So this system is designed to detect animal and send signal to controller. IoT based smart farming improves entire agriculture system by monitoring the field in real time. With the help of sensors and interconnectivity, the IoT agriculture has not only saved the time of farmers but also reduced the extravagant use of resources such as water and electricity.

2. LITERATURE SURVEY

2.1 Existing Problem

- ➢ Lack of network connection in rural areas
- ➢ Cope with climate change, soil erosion
- ➢ Invest in farm productivity
- ➢ Adopt and learn new technologies

2.2 References

1. Ahmed, S.; Shekhawat, A.S.; Kumar, S.G.; Nair, M.K.; Kumar, V. (30 October 2016)“Intelligation”: An IOT based Framework for Smarter Irrigation. In Proceedings of the National Conference on Product Design (NCPD 2016), Banglore, India.

2. Jain, S. and Vani, K.S. (2018) A survey of the automated irrigation systems and the proposal to make the irrigation system intelligent. Int. J. Comput. Sci. Eng. 6, 357–360.

3. Saraf, S.B. and Gawali, D. H. (2017) ‘IoT based smart irrigation monitoring and controlling system’

4. Sukhadeve, V.; Roy, S. (2016) Advance agro farm design with smart farming, irrigation and rain water harvesting using internet of things. Int. J. Adv. Eng. Manag.

2.3 Problem Statement Definition

A problem statement is a concise description of an issue to be addressed or a condition to be improved upon. It identifies the gap between the current (problem) state and desired (goal) state of a process or product.

I am	a farmer
I'm trying	to yield more crops by using sensors
But	lack of internet facility
Because	there is no continuous internet connection in rural areas
Which makes me feel	Disappointed

3. IDEATION & PROPOSED SOLUTION

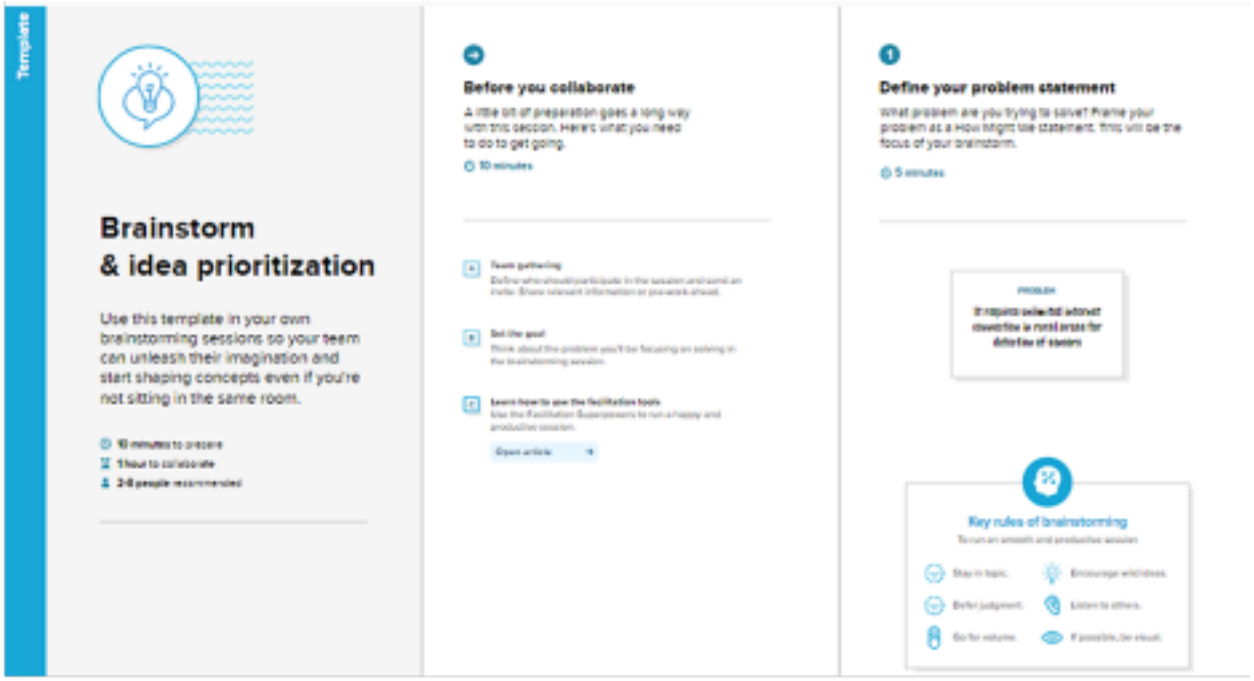
3.1 Empathy Map

Empathy map is a collaborative tool teams can use to gain a deeper insight into their customers.

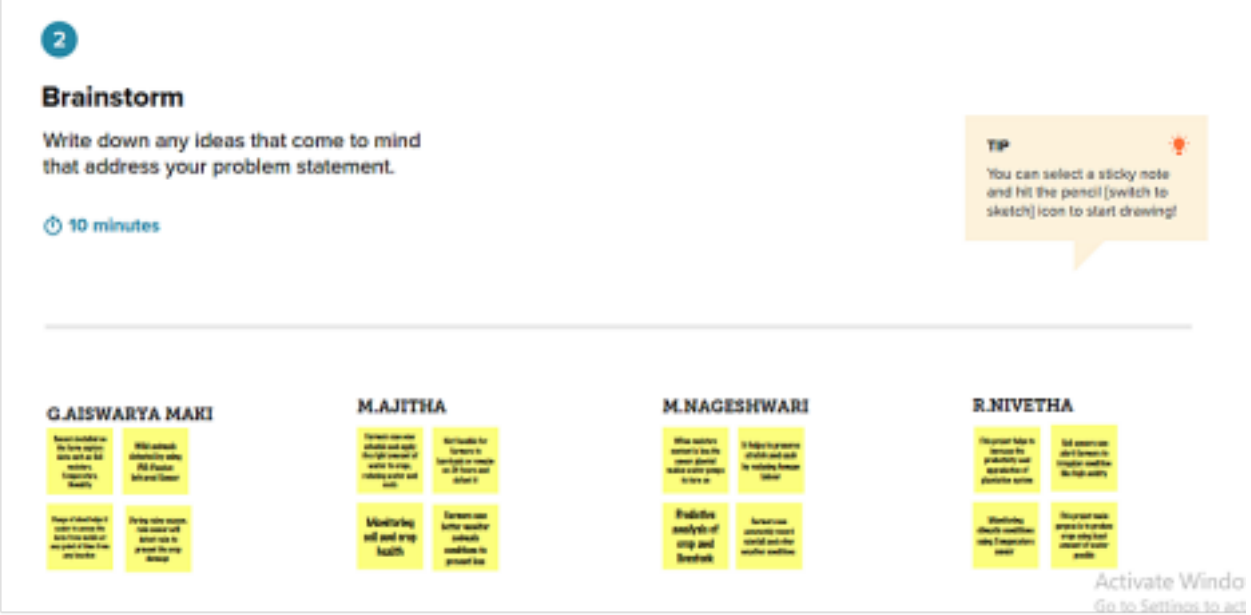
3.2 Ideation & Brainstroming

Brainstorming is a group problem-solving method that involves the spontaneous contribution of creative ideas and solution.

Step-1: Team Gathering, Collaboration and Select the Problem Statement



Step-2: Brainstorm, Idea Listing and Grouping



Step-3: Idea Prioritization

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

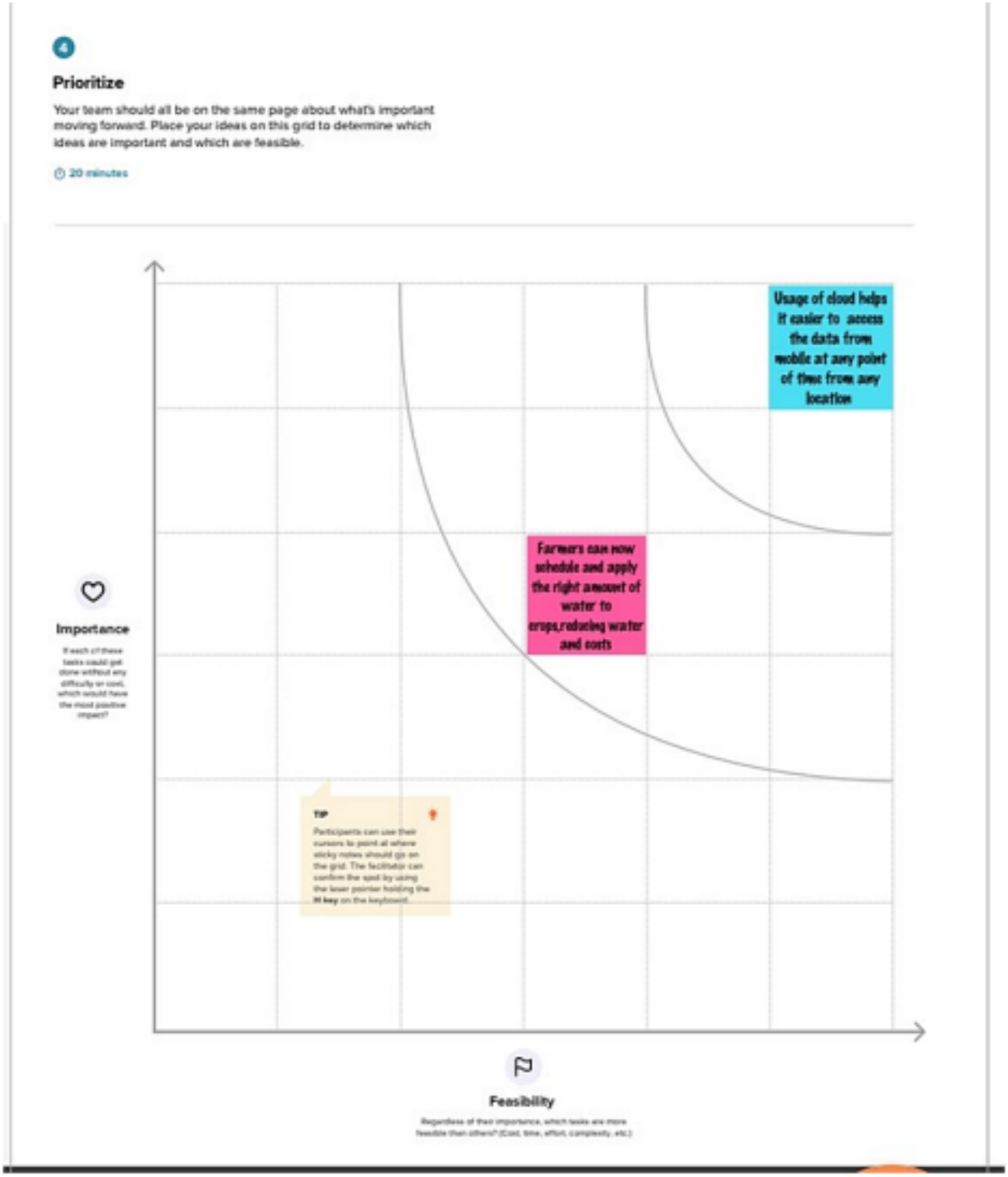
20 minutes

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

Farmers can now schedule and apply the right amount of water to crops, reducing water and costs

Usage of cloud helps it easier to access the data from mobile at any point of time from any location



3.3 Proposed Solution

Proposed solution means the technical solution to be provided by the implementation agency in response to the requirements and the objectives of the project.

S.No	Parameter	Description

1.	Problem statement (problem to be solved)	It requires unlimited internet connection in rural areas for better detection of sensors.
2.	Idea/Solution description	Install new or existing internet lines such as fiber optics in our location.
3.	Novelty/Uniqueness	Equipment usage water system control over android telephones.
4.	Social Impact/customer satisfaction	The farmer will have an accurate crop yield.
5.	Business Model (Revenue Model)	The merger and acquisition strategy helps both buyer and seller gets benefited.
6.	Scalability of the solution	Installation of fiber optics is more expensive as special test equipment is usually required.

3.4 Problem Solution Fit

Problem solution fit- this occurs you have evidence that customers care about certain jobs, pains, gains.

1.Customer Segments: Farmer is our customer.	**6.Customer Constrains:** Low availability of improved or hybrid seed, lack of seed multiplication capacity, lack of irrigation and water constraints.	**5.Available Solutions:** Install new or existing internet lines such as wifi and fiber optics in our location. Invest more in farm productivity. Adoption of new technologies better crop production.
2.Job-to-be-done/problems: Protecting crops from animals by using PIR sensor.	**9.Problem Root Cause:** climatic change, pollutants, irrigation problem, soil degradation, waste.	**7.Behaviour:** The farmers must to know how to process seeds and prepare fields for planting. It can be done by better analysis of soil and plant conditions and provide actuate information about weather conditions.
3.Triggers: Feeding a growing population, providing a livelihood for farmers, protecting the environment.	**10. Solution:** We can know the real-time status of the crops by capturing data from sensors, using predictive analysis, we can make better decisions related to harvesting. It uses modern technology to increase quantity and quality of agriculture products.	**8.Channels of Behaviour:** **Online:** By creating apps farmers can directly ask the question and query to the agriculture experts also they can watch their videos related to new technology this helps in improving crops and raising harvesting. **Offline:** By supporting local farmers, people will not only save money within the community and improve the economy in the area but they will also get better quality products at lower prices.
4.Emotoins:Before/After: Frustrated, disappointed, unfulfilled, anger, fear.		

4.REQUIREMENT ANALYSIS

4.1 Functional requirement

Functional requirements are product features or functions that developers must implement to enable users to accomplish their tasks.

FR NO.	Functional Requirement (Epic)	Sub Requirement(Story / Sub-Task)
FR-1	User classification	The user has to classify crops such as food crops like rice, wheat and industrial crops like cotton, tobacco.
FR-2	User adoption	The user has to adopt new technology for boosting production.
FR-3	User detection	The user has to detect the ratio of defected crops on land.

4.2 Non-Functional requirements

Following are the non-functional requirements of the proposed solution.

FR NO.	Non-Functional Requirement	Description
NFR-1	**Usability**	The sensors used in agriculture provides data that helps farmers to monitor and optimize crops with environmental conditions and challenges.
NFR-2	**Security**	The system is to promote more permanent and viable farming operations over the long term by strengthening the farming community's sense of security in

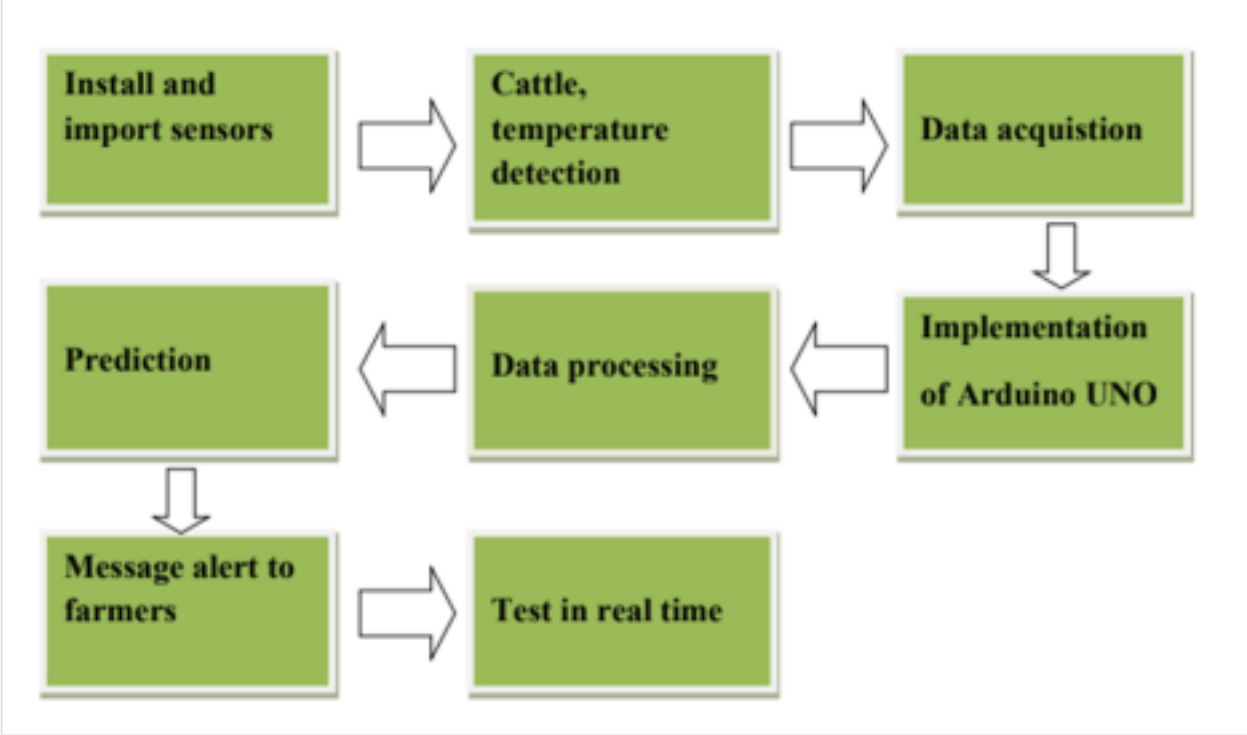
land use and the right to farm.

NFR-3	**Reliability**	The system is highly reliable. They are easy to operate and increasing demand for food with minimum resources such as water and seeds.
NFR-4	**Performance**	Sensors empower farmers to react quickly and dynamically maximize crop performance. It is cost effective and efficient.
NFR-5	**Availability**	The system is simple and easy understand by farmers to improve crop production. so it is used by all countries with different equipments.
NFR-6	**Scalability**	The usage of temperature sensor predicts accurate weather conditions. It also predicts water level and moisture content in field.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

It is a graphical representation which is very easy to understand it helps visualize contents. Data flow diagram represent detailed and well explained diagram of system components.



Flow:

➢ We start collecting data from cloud services and collect a bunch of data from sensors.

➢ Save data in the form of numpy arrays.

➢ We then implement arduino UNO with our stored data.

➢ The number of sensors for the model is determined by us, if we increase the number of sensors, the accuracy increases. But it requires much more time for implementing more sensors.

➢ Once detection is done, we can use this model for real time cattle detection and simultaneously used to detect water level and temperature in the field.

5.2 Solution & Technical Architecture

Solution Architecture

Solution architecture is the practice of designing, describing, and managing solution engineering to match it with specific business problems.

1. Customer Segment:

The farmer faces difficulty to maintain crops in larger area.

2. problems/pains:

- ➢ Cope with climatic change, soil erosion and biodiversity loss.
- ➢ When darkness falls across the farm cows, pigs, sheep, chickens entered into the farm and destroys the crop.

3. Triggers to act:

Feeding a growing population, providing a livelihood for farmers, protecting the environment.

4. Emotions:

The emotional effects of farmers are frustrated, disappointed, unfulfilled, anger, fear.

5. Available Solutions:

- ➢ Install new or existing internet lines such as wifi and fiber optics in our location.
- ➢ Invest more in farm productivity.
- ➢ Adoption of new technologies better crop production.

6. Customer Limitation:

Farmer can afford the equipment but there is unavailability of electricity 24*7 in the village areas.

7. Existing System:

- ➢ Traditional agriculture is based on treating soil and plants with products which are not noxious not synthetically produced in laboratory.
- ➢ Organic agriculture is a holistic production management system which promotes and enhances agro ecosystem health, biological cycles, soil biological activity.

➢ Conservation Agriculture (CA) is a farming system that can prevent losses of arable land while regenerating degraded lands. It also improves irrigation production.

8. Customer behavior:

➢ The farmers must to know how to process seeds and prepare fields for planting.

➢ It can be done by better analysis of soil and plant conditions and provide actuate information about weather conditions.

9. Problem Root/Cause:

➢ Irrigation is crucial for farm sector where large tracts of land still depend on monsoon rains.

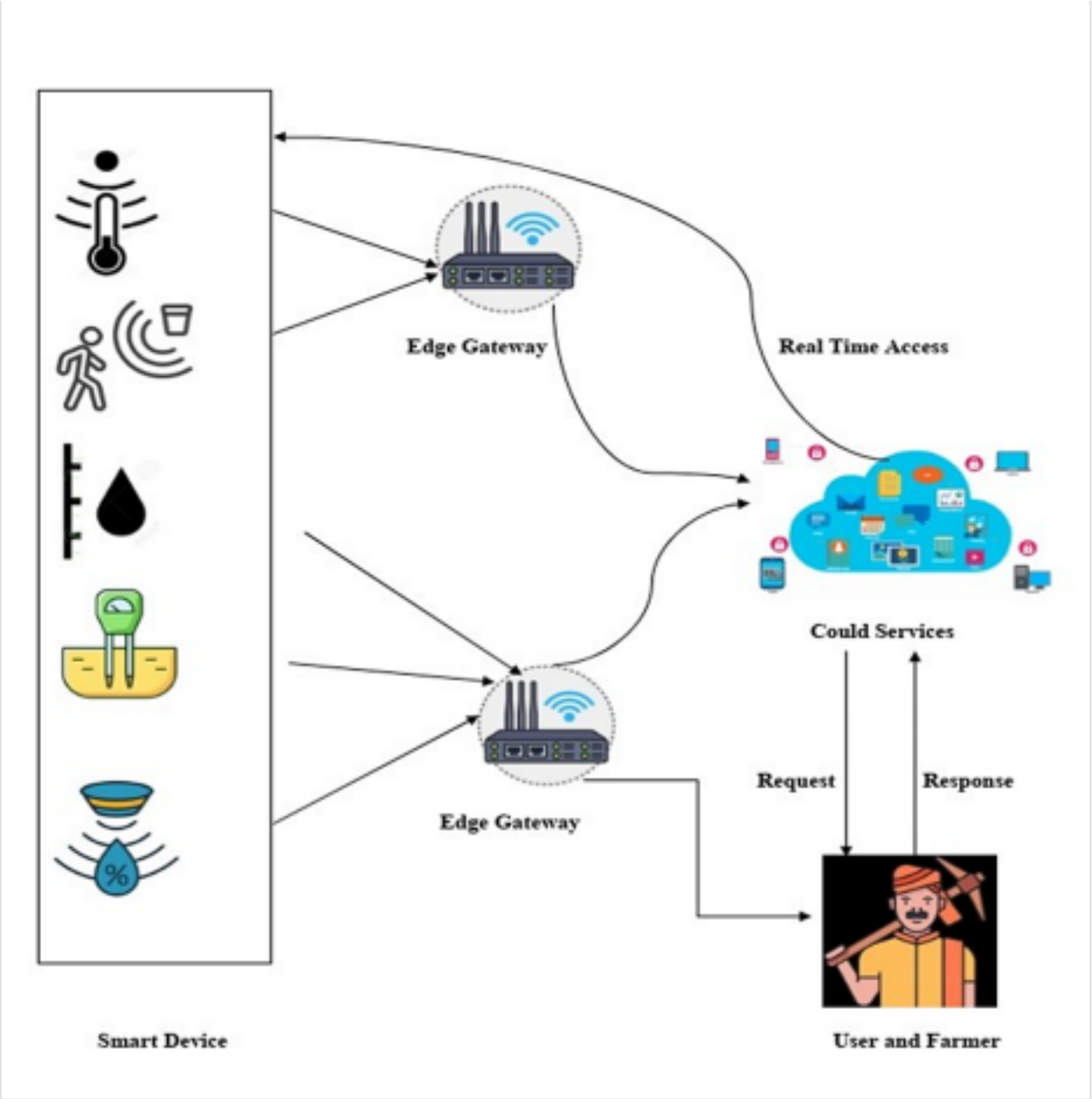
➢ climatic change, pollutants, irrigation problem, soil degradation,

waste. **10. Solution:**

➢ We can know the real-time status of the crops by capturing data from sensors, using predictive analysis, we can make better decisions related to
harvesting.

➢ It uses modern technology to increase quantity and quality of agriculture products.

Solution Architecture Diagram



Technical Architecture

Technology Architecture is a more well defined version of solution architecture. It helps us analyze and understand various technologies that needs to be implemented in the project.

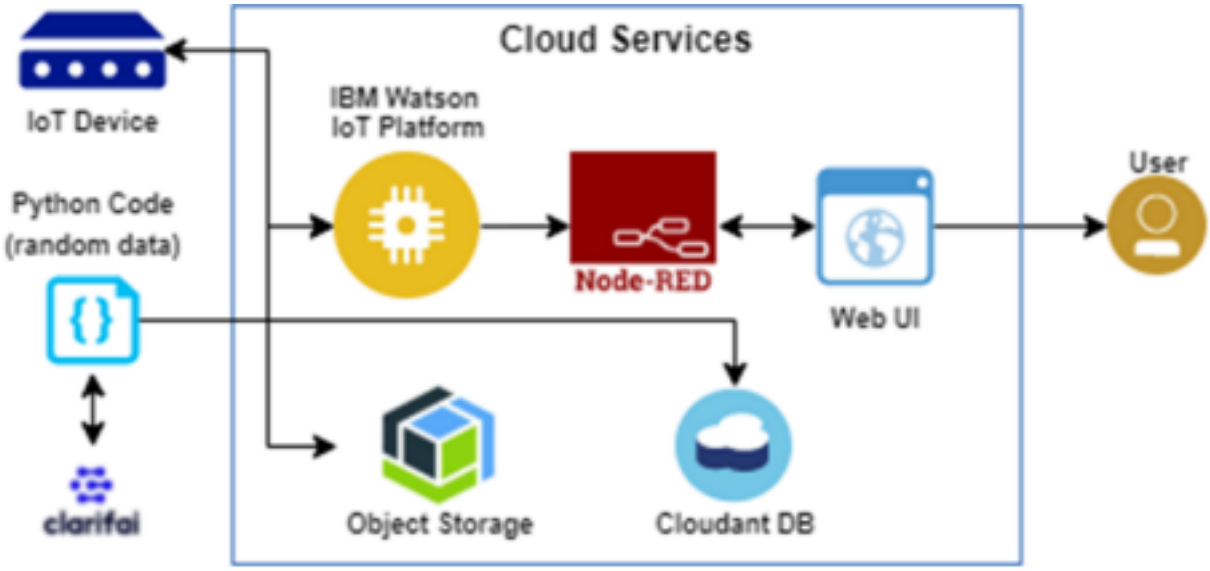


Table-1: Components &Technologies

S.No	Component	Description	Technology
1.	User interface	How user interacts with the web UI	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson/node red
4.	Application Logic-3	Logic for a process in the application	IBM Watson/node red
5.	Database Data Type, Configurations etc.	MySQL, NoSQL, etc.	
6.	Cloud Database	Database	IBM Cloudant

		Service on cloud	
7.	File Storage	File storage requirements	IBM Block Storage
8.	Infrastructure(Server/ clou d)	Application deployment on Local System/Cloud Local Server configuration: Cloud sever configuration	Cloud Foundry

Table-2:Application Characteristics

S.No	Characteristics	Description	Technology
1.	Open-Source frameworks	The open-source frameworks used	Software
2.	Security implementations	List all the security/access controls implemented	Encryption process
3.	Scalable architecture	Justify the scalability of architecture(3-tier, micro-services)	Software
4.	Availability	Justify the availability of applications (eg. use of load balancers, distributed servers etc)	Software

5.	Performance	Design consideration for the performance of the application	Software

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story/Task	Acceptance Criteria	I R	
Developer	System Building	USN-1	Collect dataset	I can collect dataset	High	Sprint-1
		USN-2	Collecting data from sensors	I can collect data from sensors	High	Sprint-1
		USN-3	Implementing arduino UNO from data collection		High	Sprint-2
		USN-4	Message alert to farmers	I can receive message	High	Sprint-3
		USN-5	Farmers identify the problem and resolve it by using mobile application	I can identify the problem and I try to resolve it	medium	Sprint-3

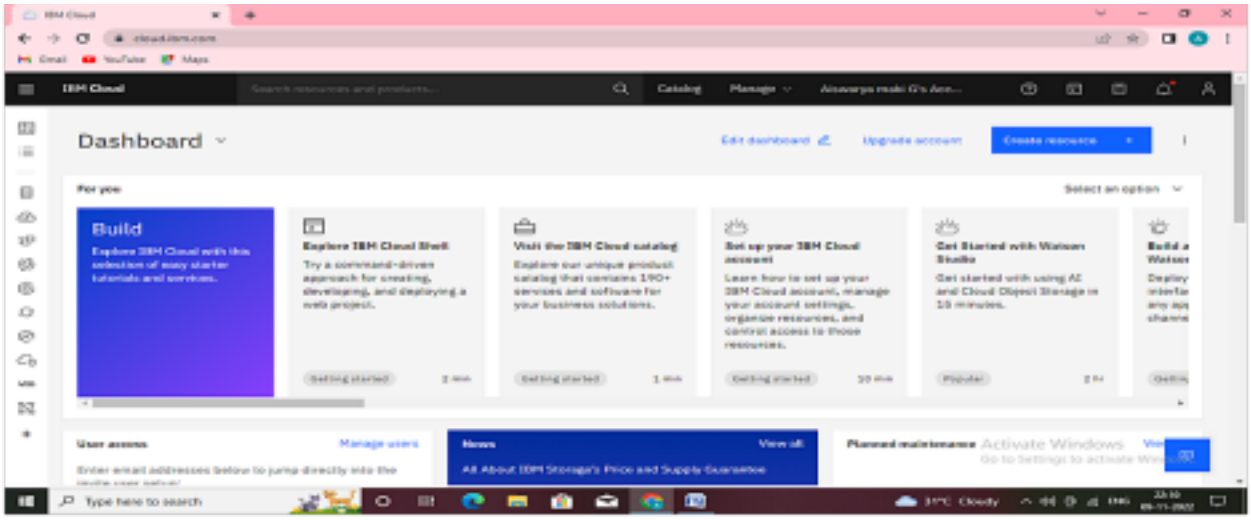
customer (web user)	Adoption	USN-1	Adopting new technology for boosting production	I can adopt new technology	Low	Sprint-1
	Detection	USN-2	Detect the ratio of defected crops on land	I can detect the defected crops	High	Sprint-2

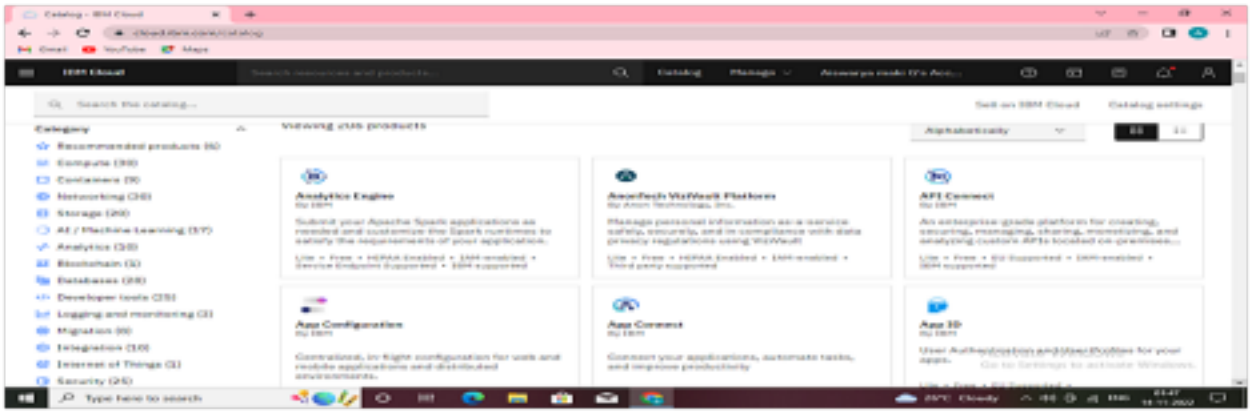
6. PROJECT PLANNING & SCHEDULING

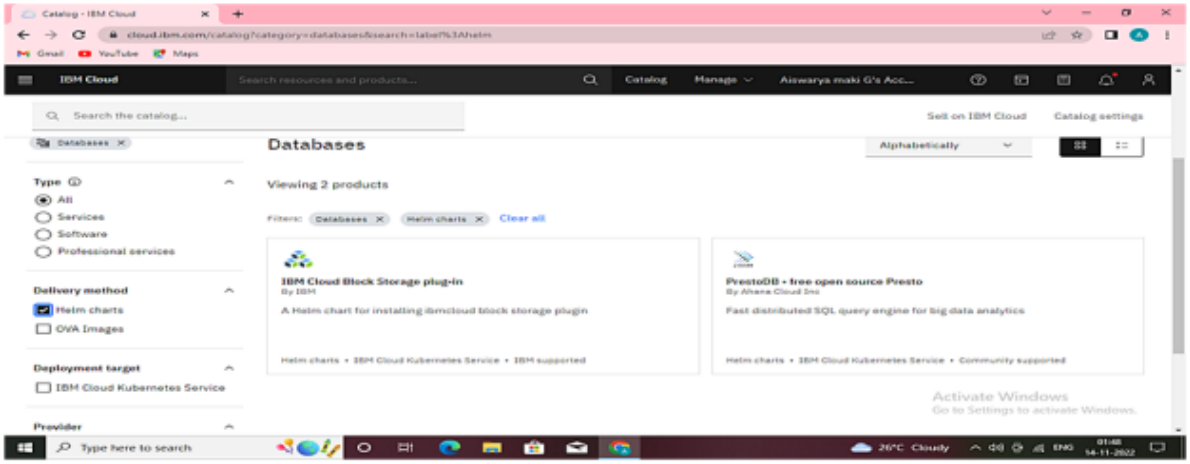
6.1 Sprint Planning & Estimation

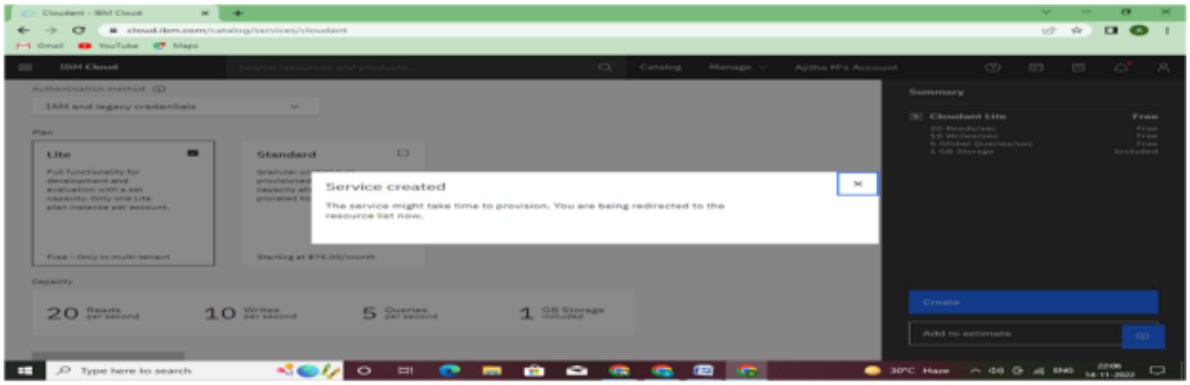
A sprint estimation shows how much effort a series of tasks require. It's based on assumptions, requirements, and dependencies of a project.

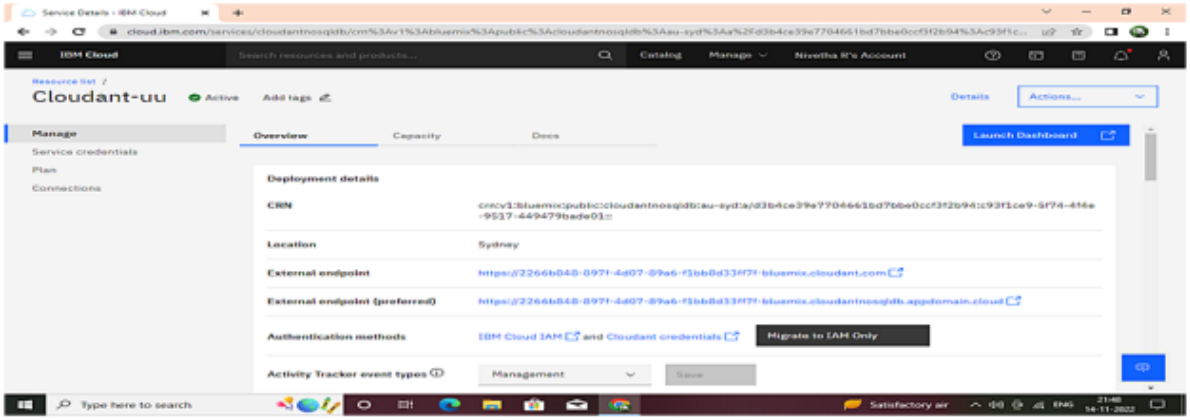
SPRINT-1:

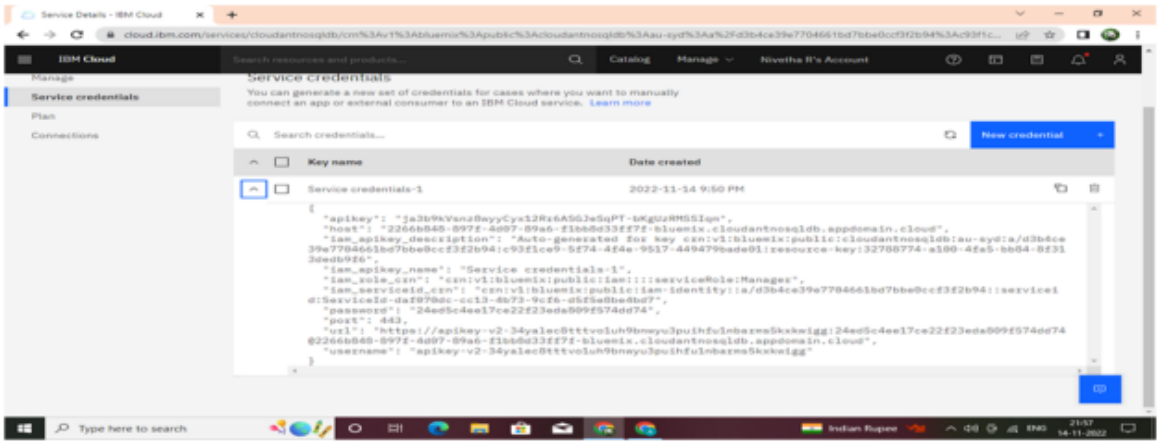



IBM Cloud
Catalog
Manage
Databases
Viewing 2 products
IBM Cloud Block Storage plug-in
Activate Windows

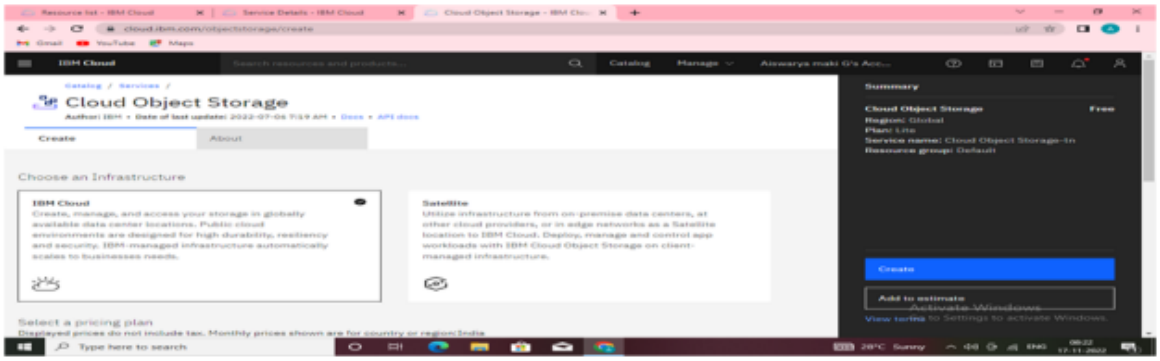

Databases
Viewing 2 products
IBM Cloud Block Storage plug-in
PrestoDB - free open source Presto

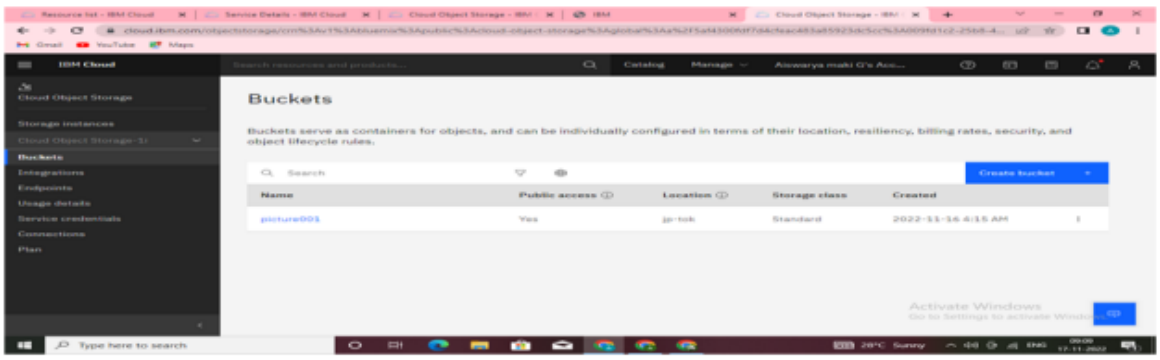

Service created
The service might take time to provision. You are being redirected to the resource list now.

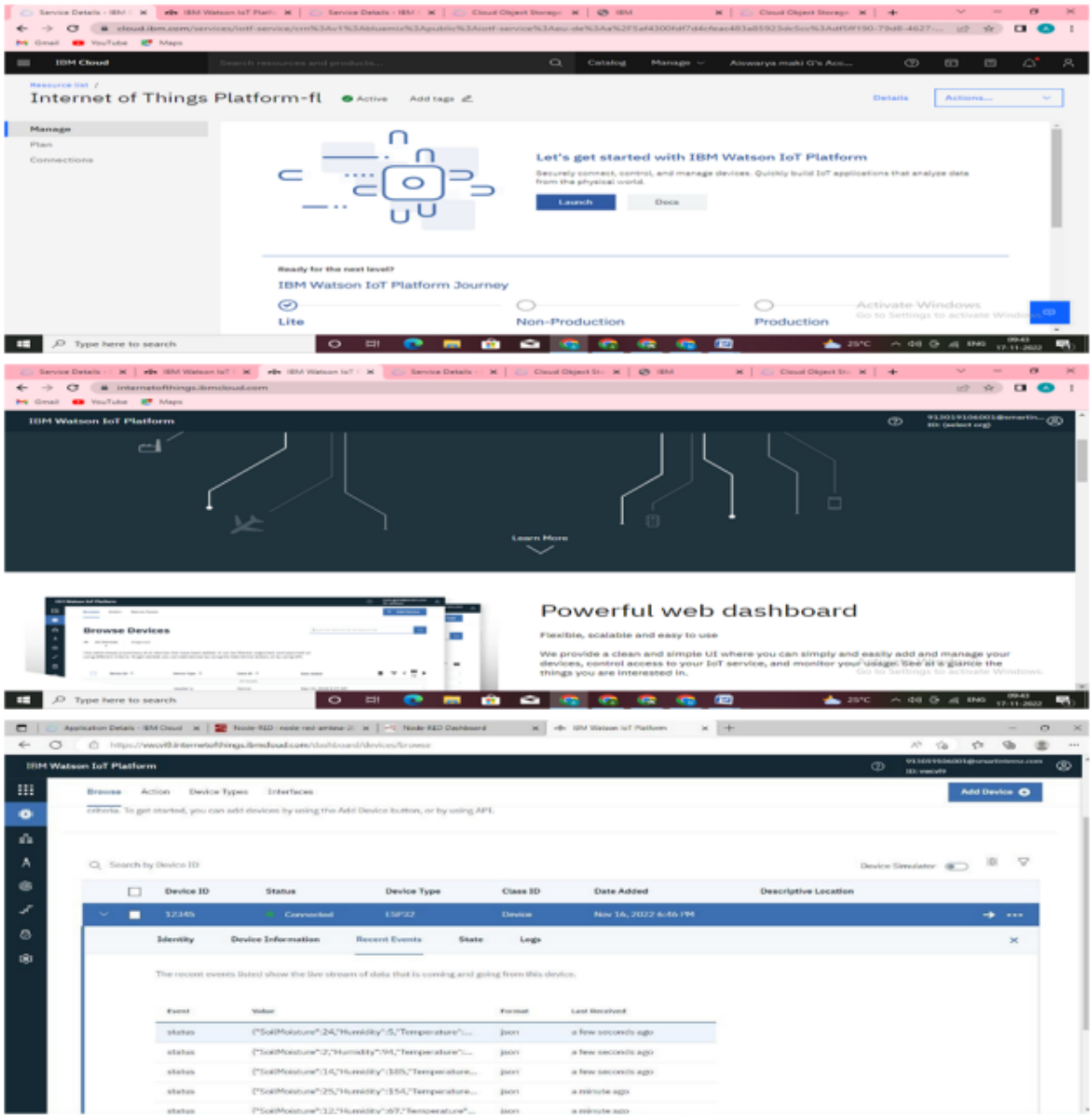

Cloudant-uu
Launch Dashboard
Deployment details


Service Details - IBM Cloud
IBM Cloud
Service credentials
You can generate a new set of credentials for cases where you want to manually connect an app or external consumer to an IBM Cloud service. Learn more
New credential
Key name
Date created
Service credentials-1
2022-11-14 9:50 PM

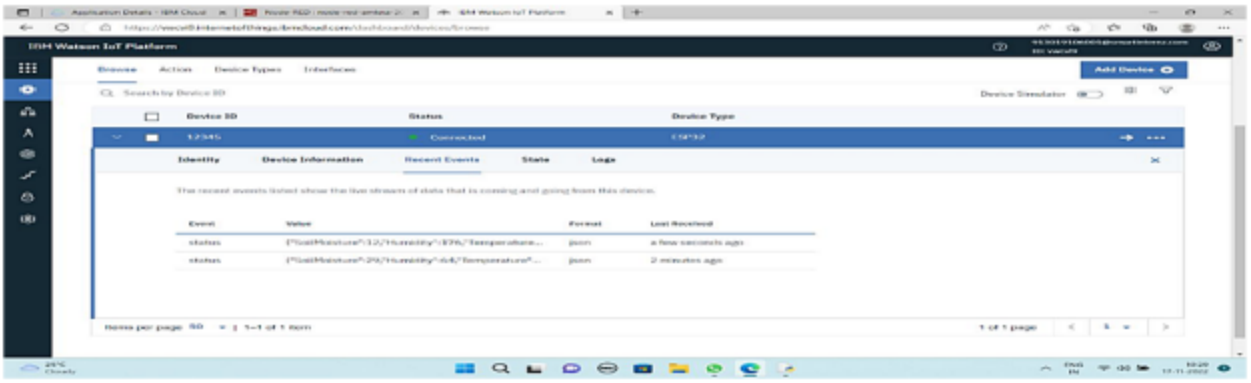
SPRINT – 2:


Cloud Object Storage
Create
About
Choose an Infrastructure
IBM Cloud
Satellite
Summary
Select a pricing plan


IBM Cloud
Cloud Object Storage
Buckets
Buckets serve as containers for objects, and can be individually configured in terms of their location, resiliency, billing rates, security, and object lifecycle rules.
Create bucket
Name
Public access
Location
Storage class
Created
picture001
Yes
Standard
2022-11-14 4:15 AM


IBM Cloud
Internet of Things Platform-fl
Active
Add tags
Manage
Plan
Connections
Let's get started with IBM Watson IoT Platform
Launch
Docs
Ready for the next level?
IBM Watson IoT Platform Journey
Lite
Non-Production
Production
IBM Watson IoT Platform
Learn More
Browse Devices
Powerful web dashboard
Flexible, scalable and easy to use
We provide a clean and simple UI where you can simply and easily add and manage your devices, control access to your IoT service, and monitor your usage. See at a glance the things you are interested in.
IBM Watson IoT Platform
Browse
Action
Device Types
Interfaces
Add Device
Search by Device ID
Device ID
Status
Device Type
Class ID
Date Added
Descriptive Location
Identity
Device Information
Recent Events
State
Logs

SPRINT – 3:


IBM Watson IoT Platform
Browse
Action
Device Types
Interfaces
Add Device
Device ID
Status
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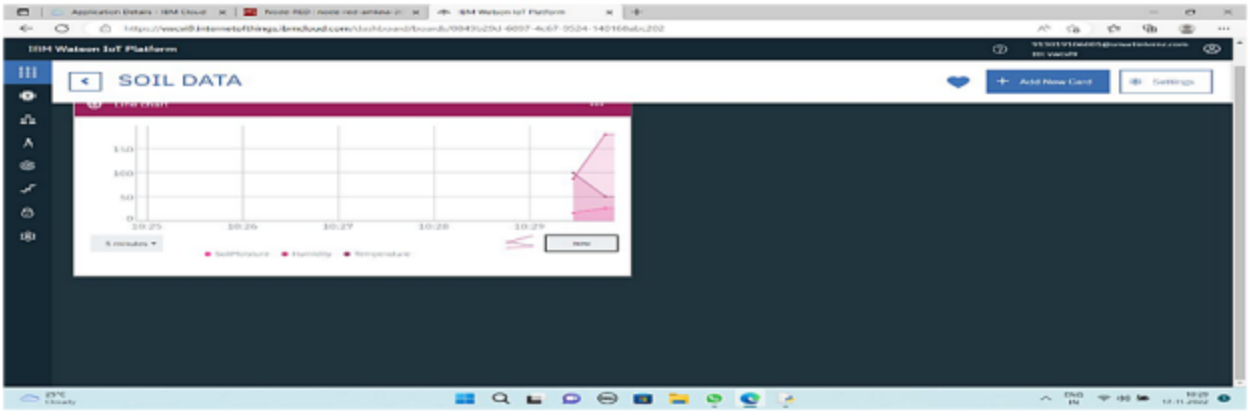
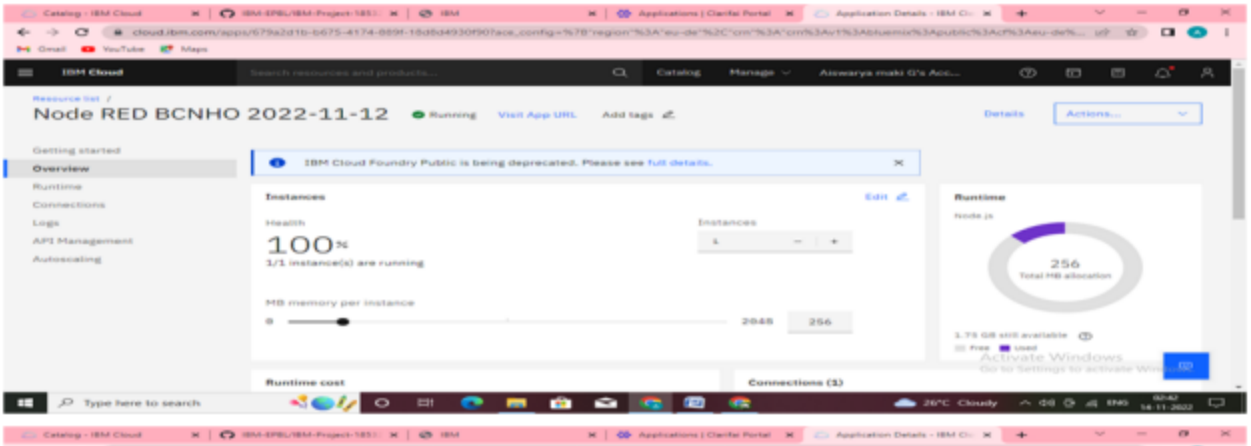
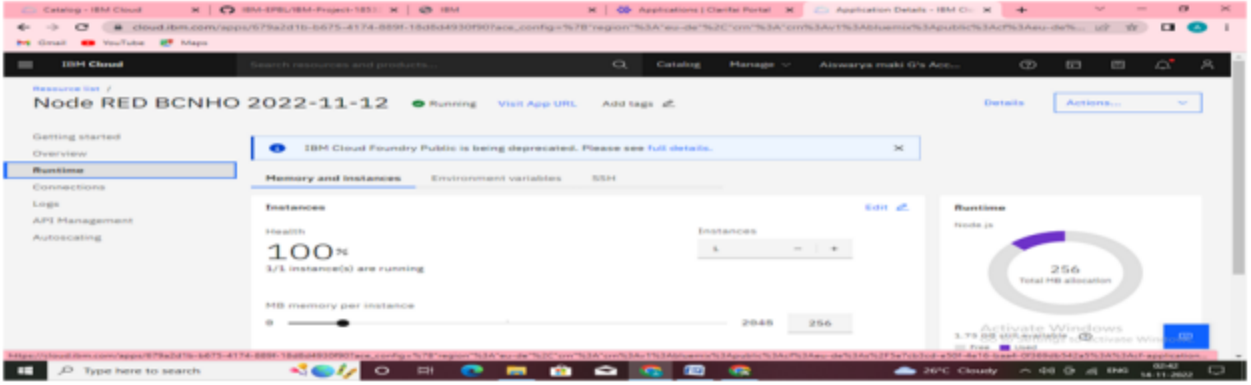
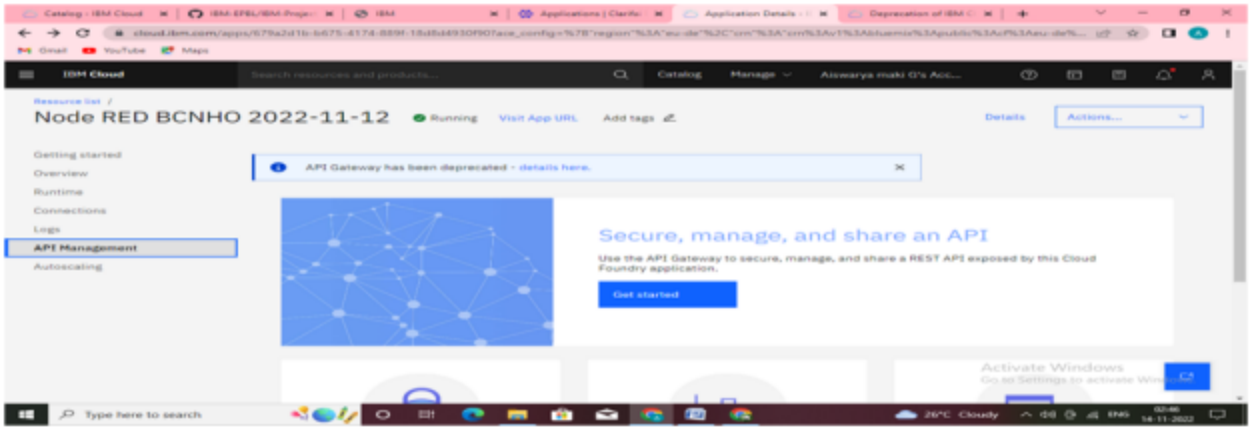
12345
Connected
ESP32
Identity
Device Information
Recent Events
State
Logs

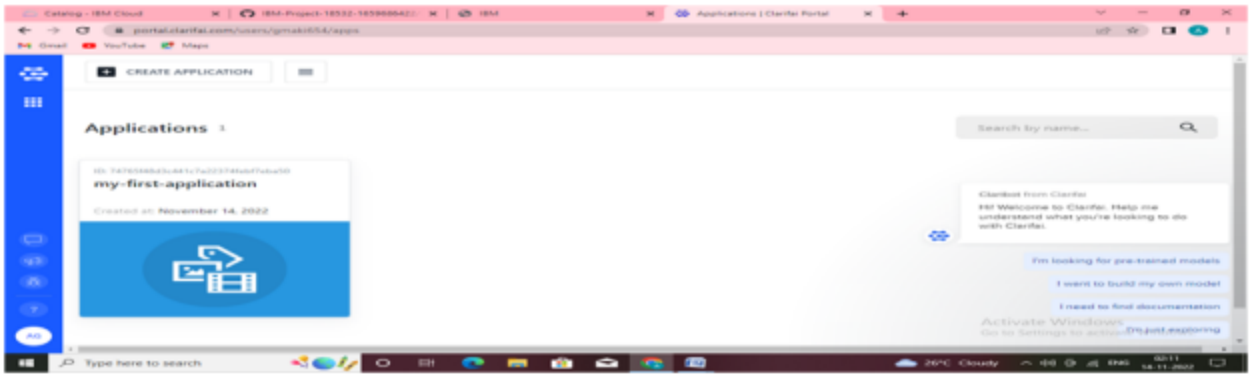

IBM Watson IoT Platform
SOIL DATA
Add New Card
Settings

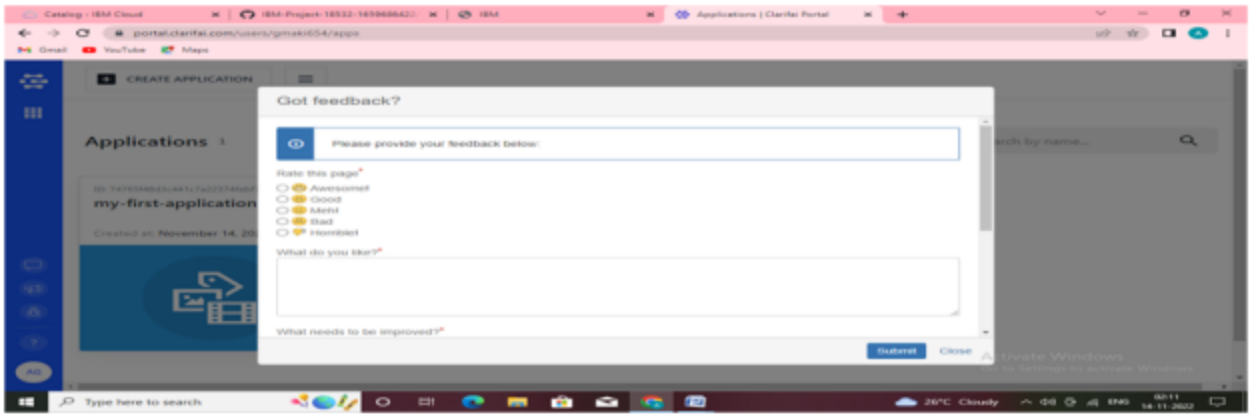

IBM Cloud
Node RED BCNHO 2022-11-12
Running
Visit App URL
Add tags
Details
Actions...
Getting started
Overview
Runtime
Connections
Logs
API Management
Autoscaling
IBM Cloud Foundry Public is being deprecated. Please see full details.
Instances
Health
100%
1/1 instance(s) are running
MB memory per instance
256
Runtime
Runtime cost
Connections (1)


IBM Cloud
Node RED BCNHO 2022-11-12
Running
Visit App URL
Add tags
Details
Actions...
Getting started
Overview
Runtime
Connections
Logs
API Management
Autoscaling
IBM Cloud Foundry Public is being deprecated. Please see full details.
Memory and instances
Environment variables
SSH
Instances
Health
100%
1/1 instance(s) are running
MB memory per instance
256
Runtime


IBM Cloud
Node RED BCNHO 2022-11-12
Running
Visit App URL
Add tags
Details
Actions...
Getting started
Overview
Runtime
Connections
Logs
API Management
Autoscaling
API Gateway has been deprecated - details here.
Secure, manage, and share an API
Use the API Gateway to secure, manage, and share a REST API exposed by this Cloud Foundry application.
Get started
Activate Windows
Type here to search
26°C Cloudy

Clarifai named a Leader in IDC MarketScape
Read our vendor assessment in IDC MarketScape: Worldwide General-Purpose Computer Vision AI Software Platforms.
clarifai
Get Started with a Free Account
First Name
Aiswarya maki
Last Name
G
Email
gmaki6554@gmail.com
Password
maki@2710
I agree to Clarifai Terms of Service and have read and acknowledge the Privacy Policy.
I'm not a robot
Activate Windows
Type here to search
26°C Cloudy


CREATE APPLICATION
Applications 1
Search by name...
my-first-application
Created on November 14, 2022
Clarifai Bot
Hi! Welcome to Clarifai. Help me understand what you're looking to do with Clarifai.
I'm looking for pre-trained models
I want to build my own model
I need to find documentation
I'm just exploring
Activate Windows
Type here to search
26°C Cloudy


CREATE APPLICATION
Applications 1
my-first-application
Got feedback?
Please provide your feedback below:
Rate this page*
Awesome!
Good
Meh!
Bad
Horrible!
What do you like?*
What needs to be improved?*
Submit
Close
Activate Windows
Type here to search
26°C Cloudy

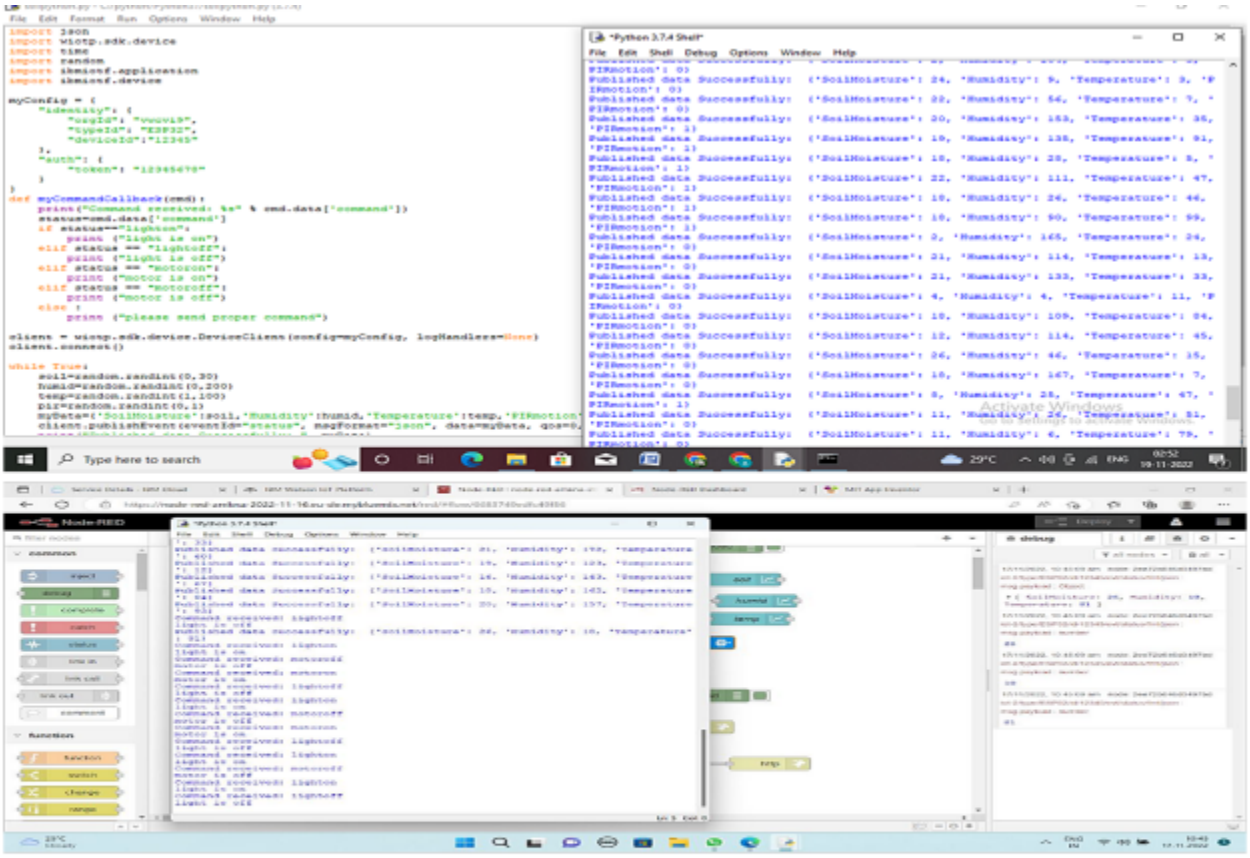
SPRINT – 4:

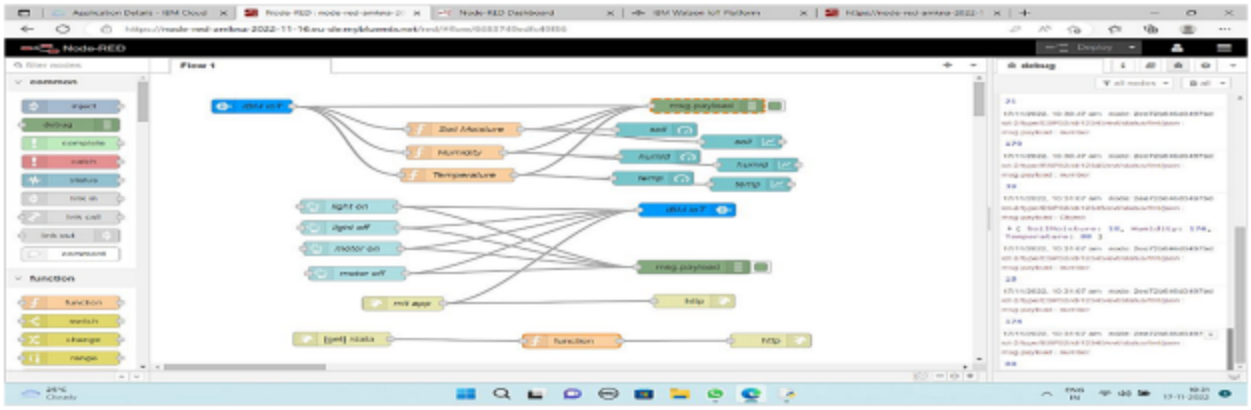
PROGRAM:

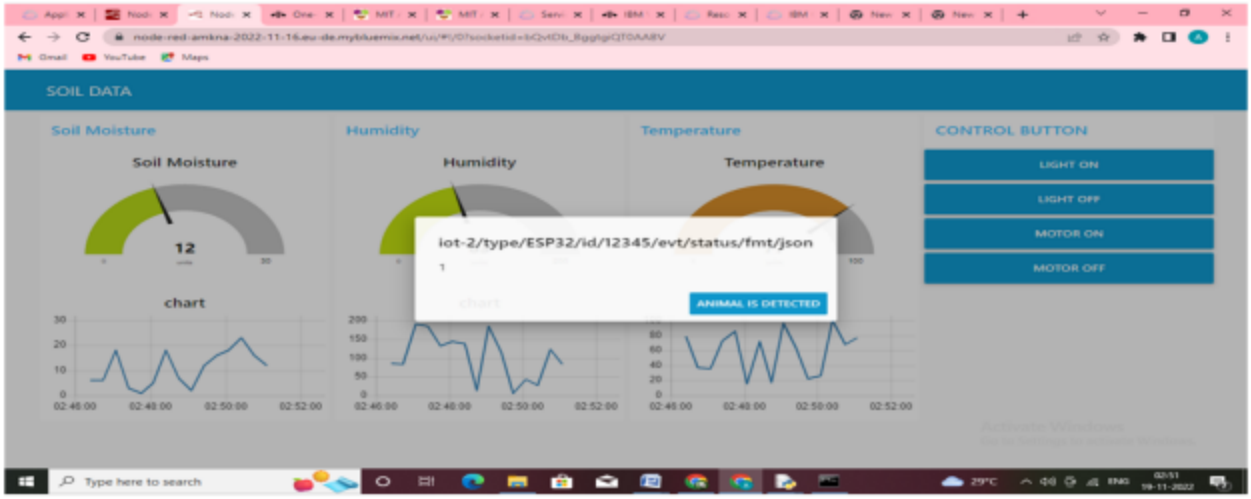
```
import json
import wiotp.sdk.device
import time
import random
import ibmiotf.application
import ibmiotf.device

myConfig = {
        "identity": {
                "orgId": "vwcvi9",
                "typeId": "ESP32",
                "deviceId":"12345"
        },
        "auth": {
                "token": "12345678"
        }
}
def myCommandCallback(cmd):
        print("Command received: %s" % cmd.data['command'])
        status=cmd.data['command']
        if status=="lighton":
                print ("light is on")
        elif status == "lightoff":
                print ("light is off")
        elif status == "motoron":
                print ("motor is on")
        elif status == "motoroff":
                print ("motor is off")
        else :
                print ("please send proper command")

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None) client.connect()

while True:
        soil=random.randint(0,30)
        humid=random.randint(0,200)
        temp=random.randint(1,100)
        pir=random.randint(0,1)
myData={'SoilMoisture':soil,'Humidity':humid,'Temperature':temp,'PIRmotion ':pir}
        client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
        print("Published data Successfully: ", myData)
        time.sleep(20)
```

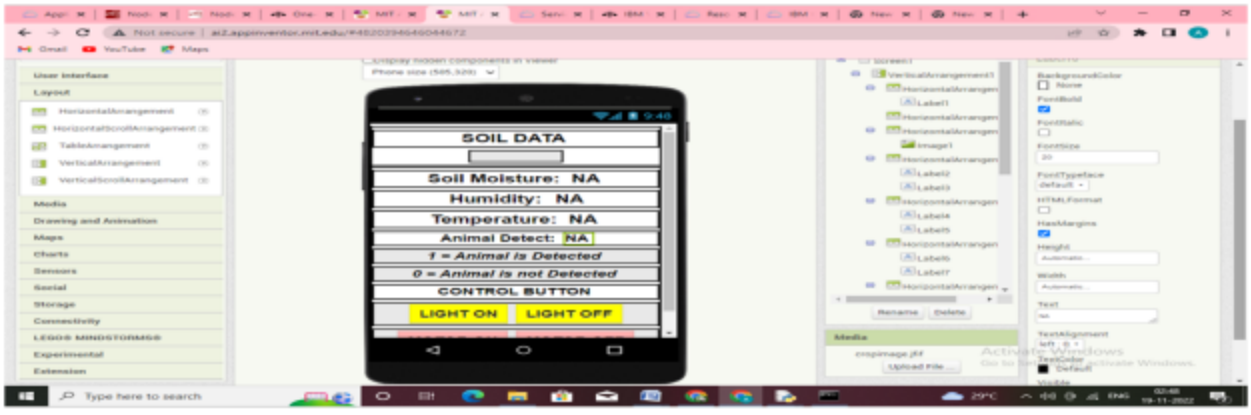
client.commandCallback = myCommandCallback

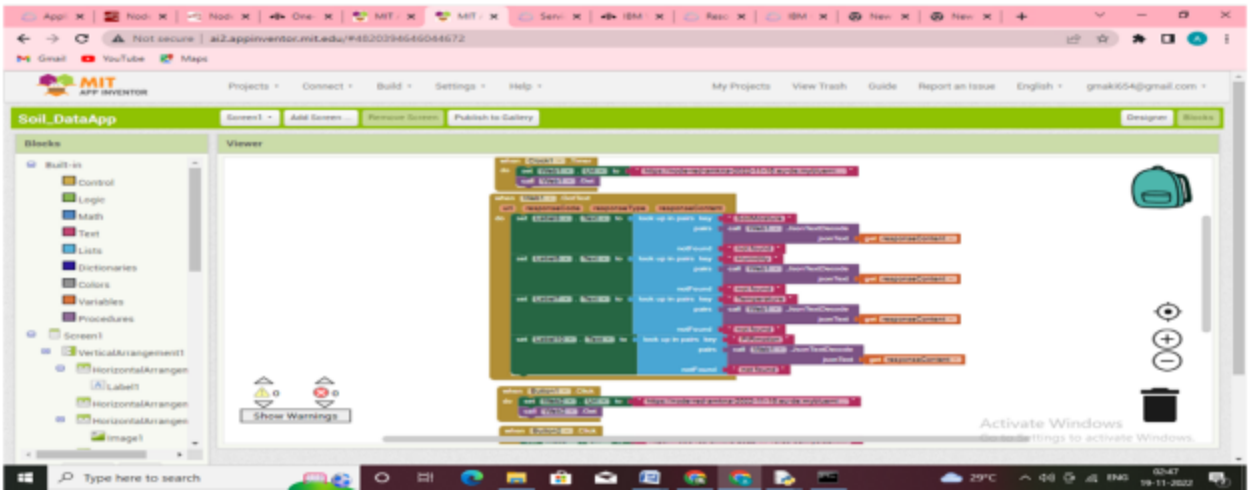
client.disconnect()




Node-RED
Flow 1
iot in
Soil Moisture
Humidity
Temperature
light on
light off
motor on
motor off
mit app
msg.payload
http
function


SOIL DATA
Soil Moisture
Humidity
Temperature
CONTROL BUTTON
Soil Moisture
12
chart
iot-2/type/ESP32/id/12345/evt/status/fmt/json
1
ANIMAL IS DETECTED
LIGHT ON
LIGHT OFF
MOTOR ON
MOTOR OFF
Type here to search


SOIL DATA
Soil Moisture: NA
Humidity: NA
Temperature: NA
Animal Detect: NA
1 = Animal is Detected
0 = Animal is not Detected
CONTROL BUTTON
LIGHT ON
LIGHT OFF
Type here to search



6.2 Sprint Delivery Schedule

Sprint planning is an event in the scrum framework where the team determines the product backlog items they will work on during that sprint and discusses their initial plan for completing those product backlog items.

Sprint-3		US-1	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.	10	High	Aiswarya maki Ajitha Nageshwari Nivetha
Sprint-3		US-2	Create a Node-RED service.	10	High	Aiswarya maki Ajitha Nageshwari Nivetha,
Sprint-3		US-1	Create an account in clarifai	7	High	Aiswarya maki Ajitha Nageshwari Nivetha
Sprint-4		US-2	Develop a python script to publish random sensor data such as temperature, moisture, soil and humidity to the IBM IoT platform.	5	Medium	Aishwarya maki Ajitha Nageshwari Nivetha
Sprint-4		US-3	Publish Data to The IBM Cloud	8	High	Aishwarya maki Ajitha Nageshwari Nivetha
Sprint-4		US-1	Configure the Node-RED flow to receive data from the IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in the cloudant DB	10	High	Aishwarya maki Ajitha Nageshwari Nivetha

Project Tracker, Velocity & Burndown Chart: (4 Marks):

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022

Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

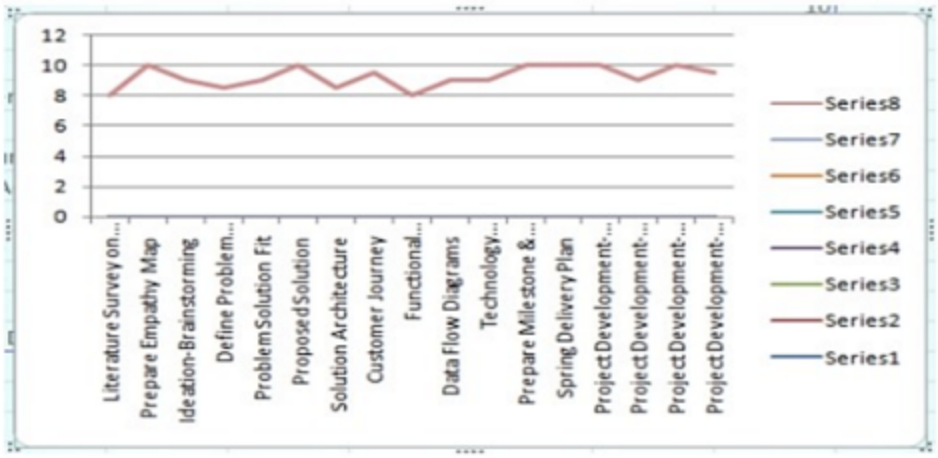
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

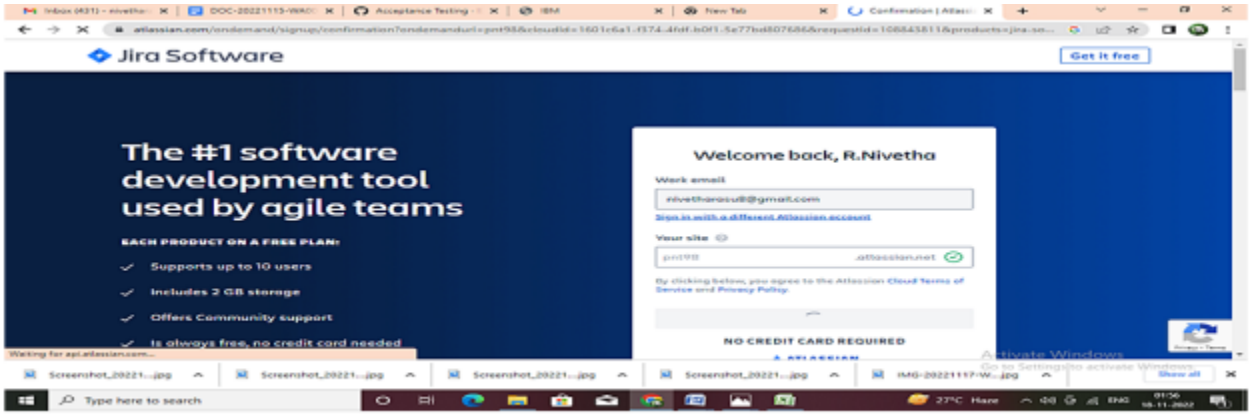
Burndown Chart:

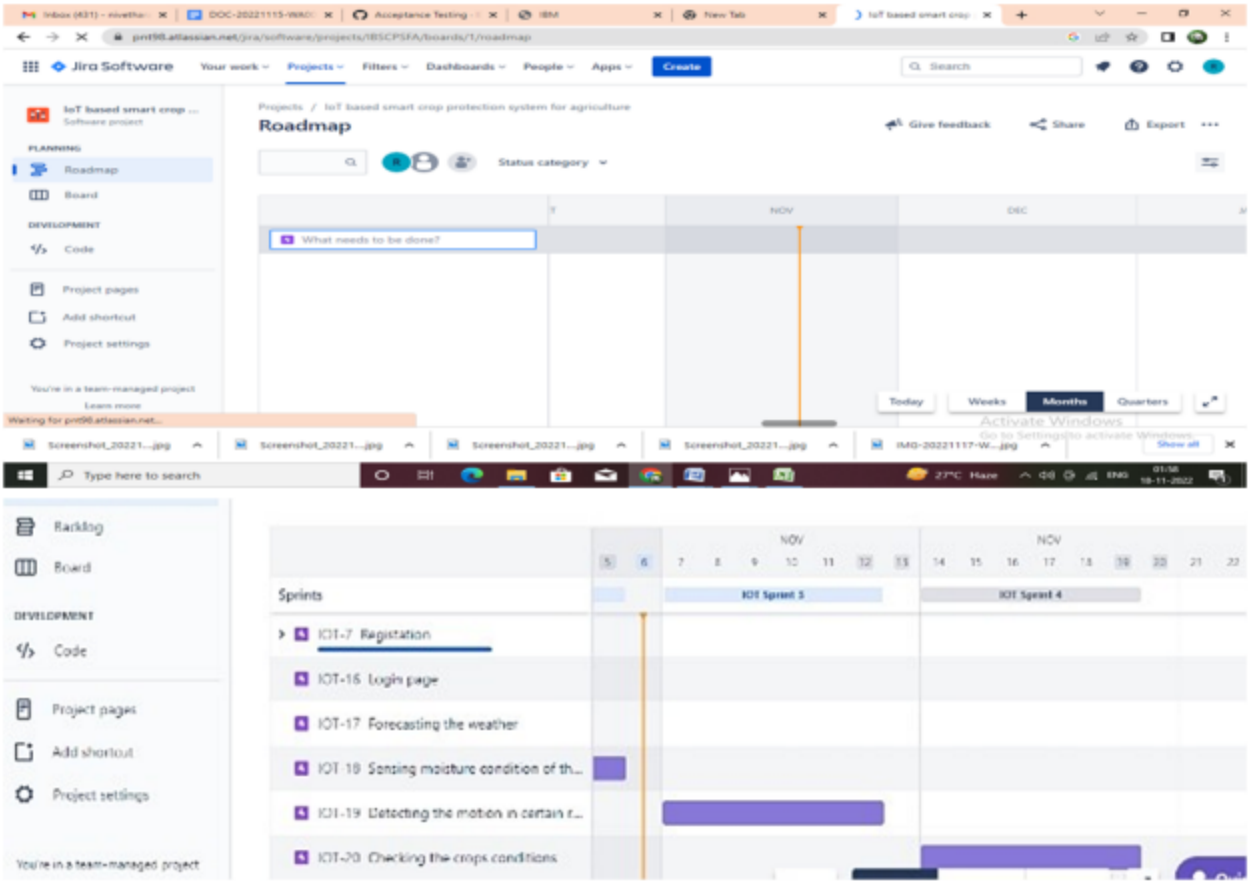
A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



6.3 Report from JIRA

JIRA is a very effective and easy to use tool for project management using agile methodologies. Each work item can be linked to a change set of the code delivered.

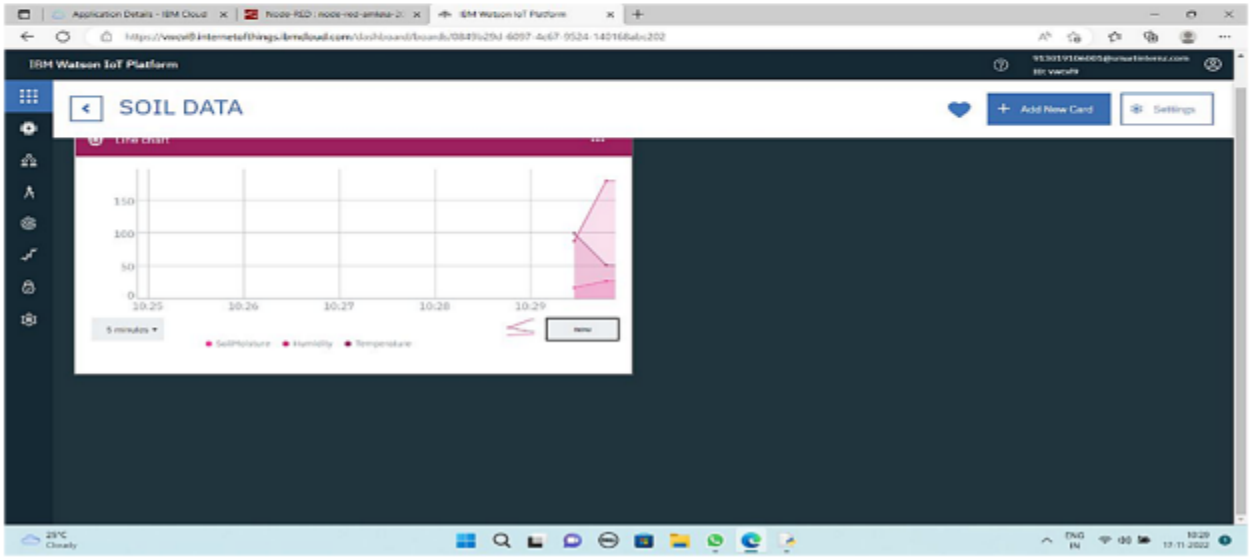




7. CODING & SOLUTIONING

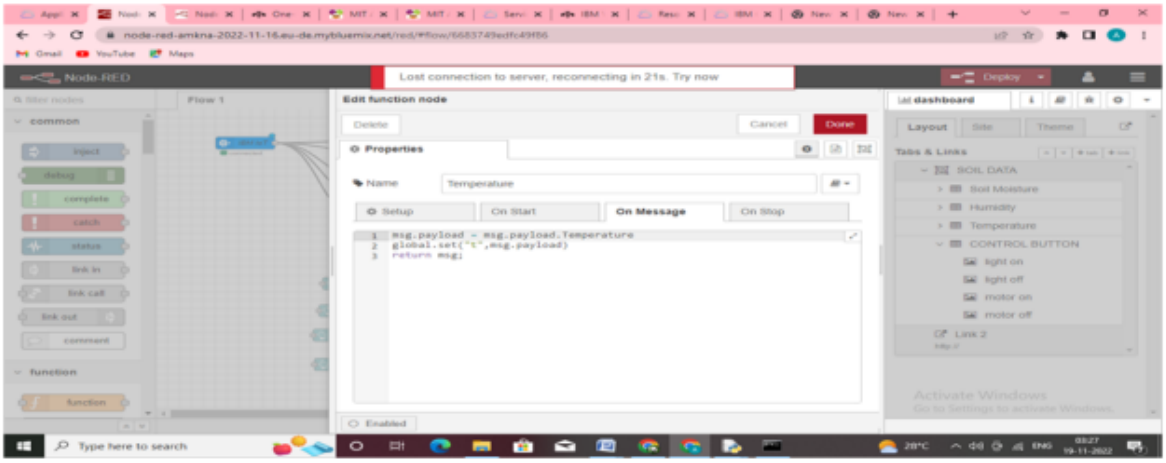
7.1 Feature 1

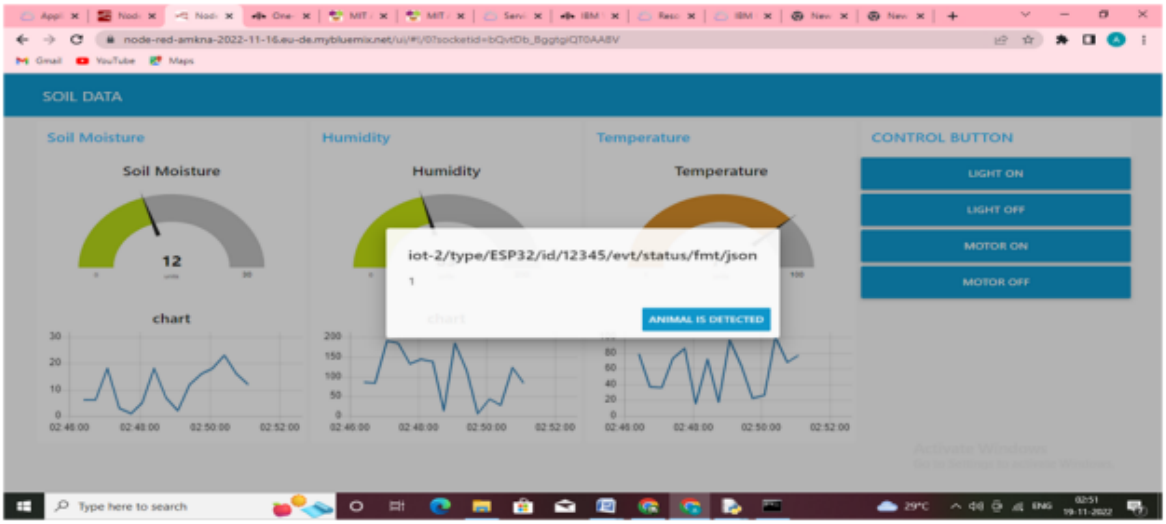
The moisture contents in the soil sensed by using the moisture sensor and it will identify the amount of water supplied required to the crop and sends data to ARM cortex and enables sensor to supply water which automatically turn on the water source and turn off it when need is satisfied.



7.2 Feature 2

PIR sensor used to detect whether a human has moved in or out of the sensors range. After processing the available information, if the human is not found the system raised the buzzer sound, to alert people about intrusion.





8. TESTING

8.1 Test Cases

A test cases is a specification of the inputs, execution conditions, test and procedure, and expected results that define a single test to be executed to achieve a particular software testing objective, such as to exercise a particular program path or to verify compliance with a specific requirement.

8.2 User Acceptance Testing

User Acceptance Testing(UAT) also called application testing or end-user testing, is a phase of software development in which the software is tested in the real world by it's intended audience.

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	5	3	2	19
Duplicate	1	1	3	1	6
External	2	3	1	1	7
Fixed	10	2	3	18	33
Not Reproduced	1	1	2	1	5
Skipped	1	1	2	1	5
Won't Fix	1	4	3	1	9

Totals 25 17 17 25 84

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	6	0	0	6
Client Application	48	0	0	48
Security	3	0	0	3
Outsource Shipping	2	0	0	2

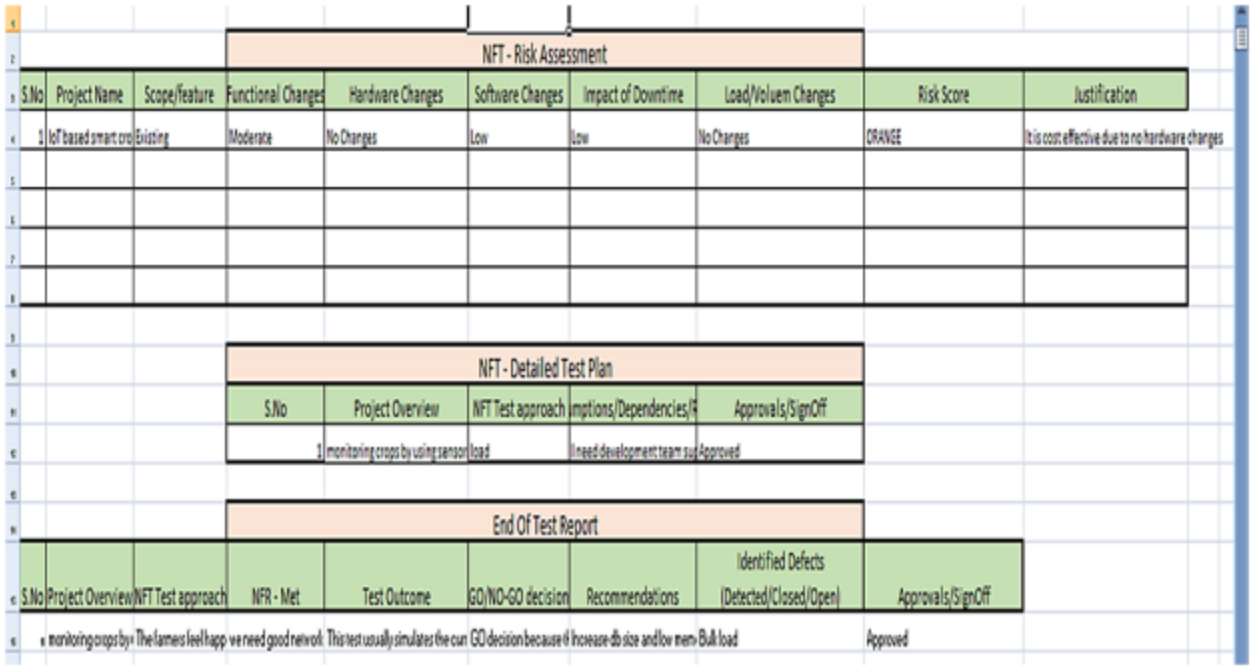
Exception Reporting	8	0	0	8
Final Report Output	5	0	0	5

Version Control2002

9. RESULTS

9.1 Performance Metrics

Performance testing comes under quality assurance checks of software / application in which speed, capacity and stability are the major checks.



NFT - Risk Assessment

S.No	Project Name	Scope/Feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
1	IoT based smart crop	Existing	Moderate	No Changes	Low	Low	No Changes	ORANGE	It is cost effective due to no hardware changes

NFT - Detailed Test Plan

S.No	Project Overview	NFT Test approach	mptions/Dependencies/R	Approvals/SignOff
1	monitoring crops by using sensors	load	I need development team sup	Approved

End Of Test Report

S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
1	monitoring crops by	The farmers feel happ	we need good network	This test usually simulates the curr	GO decision because it	increase db size and low memo	Bulk load	Approved

10. ADVANTAGES & DISADVANTAGES

Advantages

- They are easy to operate and use and easy to maintain.
- Sensors are cheaper in price and best in quality.
- Automating processes in planting, treatment and harvesting can reduce consumption, human error and overall cost.
- It is cost effective method.

➢ It delivers high quality crop production.

Disadvantages

➢ The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. Moreover internet connection is over.

➢ The smart farming based equipments require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries.

11. CONCLUSION

By using IoT, we can increase the crop yield in agriculture farms. With this IoT platform, we can monitor the weather conditions like Humidity and Temperature. There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer's side. The proposed system can be used to turn ON / OFF the water spray according to Soil Moisture levels thus making the irrigation process one of the most time-consuming agricultural activities. Agriculture is one of the biggest uses of water.

12. FUTURE SCOPE

The number of challenges and limitations considers the most IoT-based devices for smart agriculture. The main focus is cost effectiveness in the IoT devices in the reduction of hardware and software cost with compromising precision system output. The standardization of the data format for the process will also provide improved device consistency and execution time.

13. APPENDIX

Source code

```
import json
import wiotp.sdk.device
import time
import random
import ibmiotf.application
import ibmiotf.device
```

```
myConfig = {
        "identity": {
                "orgId": "vwcvi9",
                "typeId": "ESP32",
                "deviceId":"12345"
        },
        "auth": {
                "token": "12345678"
        }
}
def myCommandCallback(cmd):
        print("Command received: %s" % cmd.data['command'])
        status=cmd.data['command']
        if status=="lighton":
                print ("light is on")
        elif status == "lightoff":
                print ("light is off")
        elif status == "motoron":
                print ("motor is on")
        elif status == "motoroff":
                print ("motor is off")
        else :
                print ("please send proper command")

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None) client.connect()

while True:
        soil=random.randint(0,30)
        humid=random.randint(0,200)
        temp=random.randint(1,100)
        pir=random.randint(0,1)
myData={'SoilMoisture':soil,'Humidity':humid,'Temperature':temp,'PIRmotion ':pir}
        client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
        print("Published data Successfully: ", myData)
        time.sleep(20)

        client.commandCallback = myCommandCallback

client.disconnect()
```

GitHub & Project Demo Link

https://github.com/IBM-EPBL/IBM-Project-47758-1660802061

DEMO VIDEO LINK:

https://youtu.be/aegFk-4qG2M